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# **Module 5: Site Characterization and Treatability Studies**

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### **Module Objectives**

- ❑ **Identify the four principles of environmental restoration**
- ❑ **List the activities that should occur in support of site characterization**
- ❑ **Identify the types of data that must be obtained to define a site's physical characteristics, characterize sources of contamination, and model contaminant fate and transport**
- ❑ **Explain how data collection decisions should be driven by the decision-making needs of the RI/FS**
- ❑ **List the situations that define when site characterization is adequate or complete**
- ❑ **Explain why communication between site manager and EPA is important during the RI/FS**

### **Module Objectives (con't)**

- ❑ **List site characterization deliverables**
- ❑ **Identify the purpose and importance of treatability studies**
- ❑ **Compare and contrast bench testing and pilot testing treatability studies**
- ❑ **Explain the RCRA sample exclusion rule**

# Site Characterization

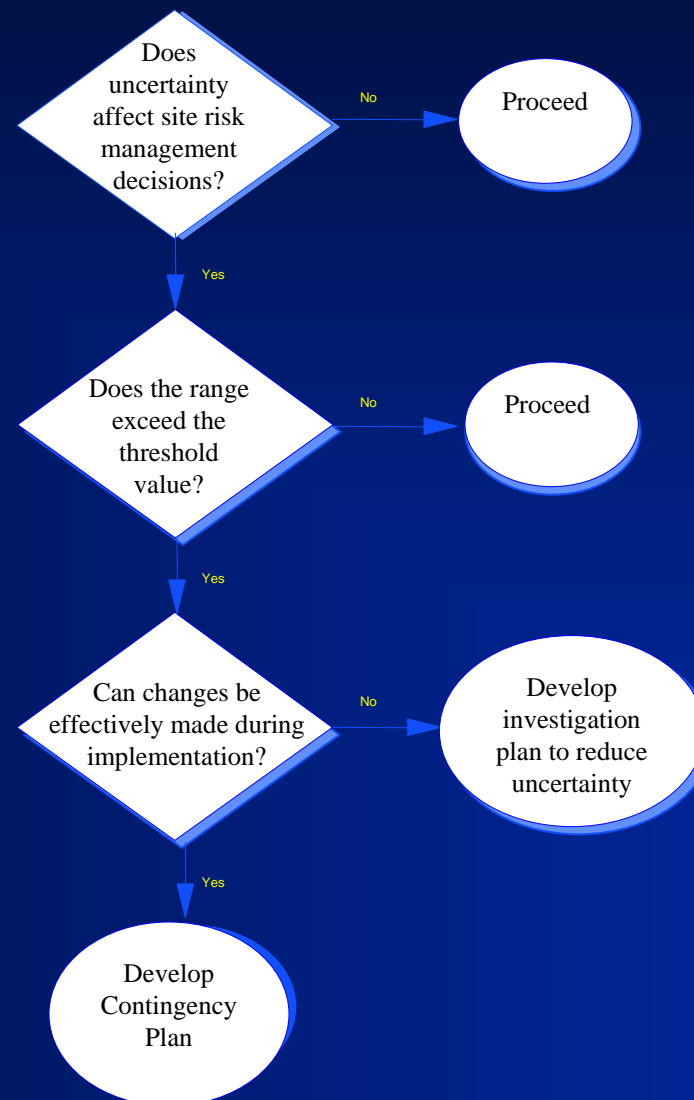
### *Purpose*

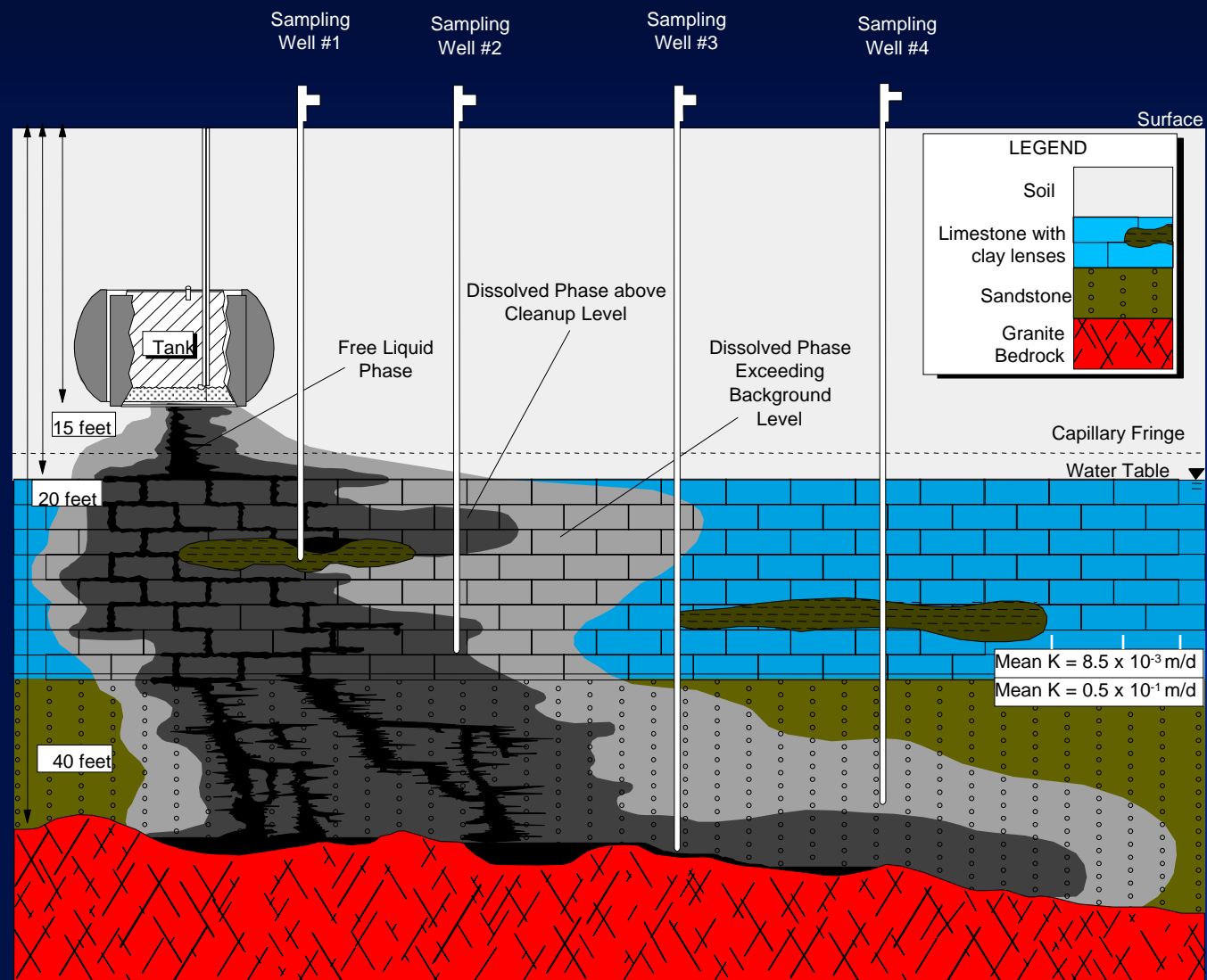
- ❑ Assess risks to human health and the environment
- ❑ Identify appropriate remedial action alternatives to mitigate current and potential threats
- ❑ Gather data on design/operation parameters for potential remedial technologies
- ❑ Identify opportunities for early action

### Problem statements and likely response actions: leaking tank example

Problem Statement(s)	Likely Response Actions
1. Underground storage tank releasing TCE and Tc-99 to environment	a. Remove tank b. Remove contents of tank and grout tank in place
2. TCE and Tc-99 released to subsurface soils in excess of regulatory criteria.	a. Remove contaminant from soils contaminated in excess of regulatory criteria b. Remove soils contaminated in excess of regulatory criteria
3. Free-liquid phase and dissolved phase plumes exceed ground water cleanup levels of 5 ppb TCE and 300 pCi/L Tc-99	a. Control plume migration using pump and treat b. Conduct in-situ stripping of plume

# Uncertainty Management Approach



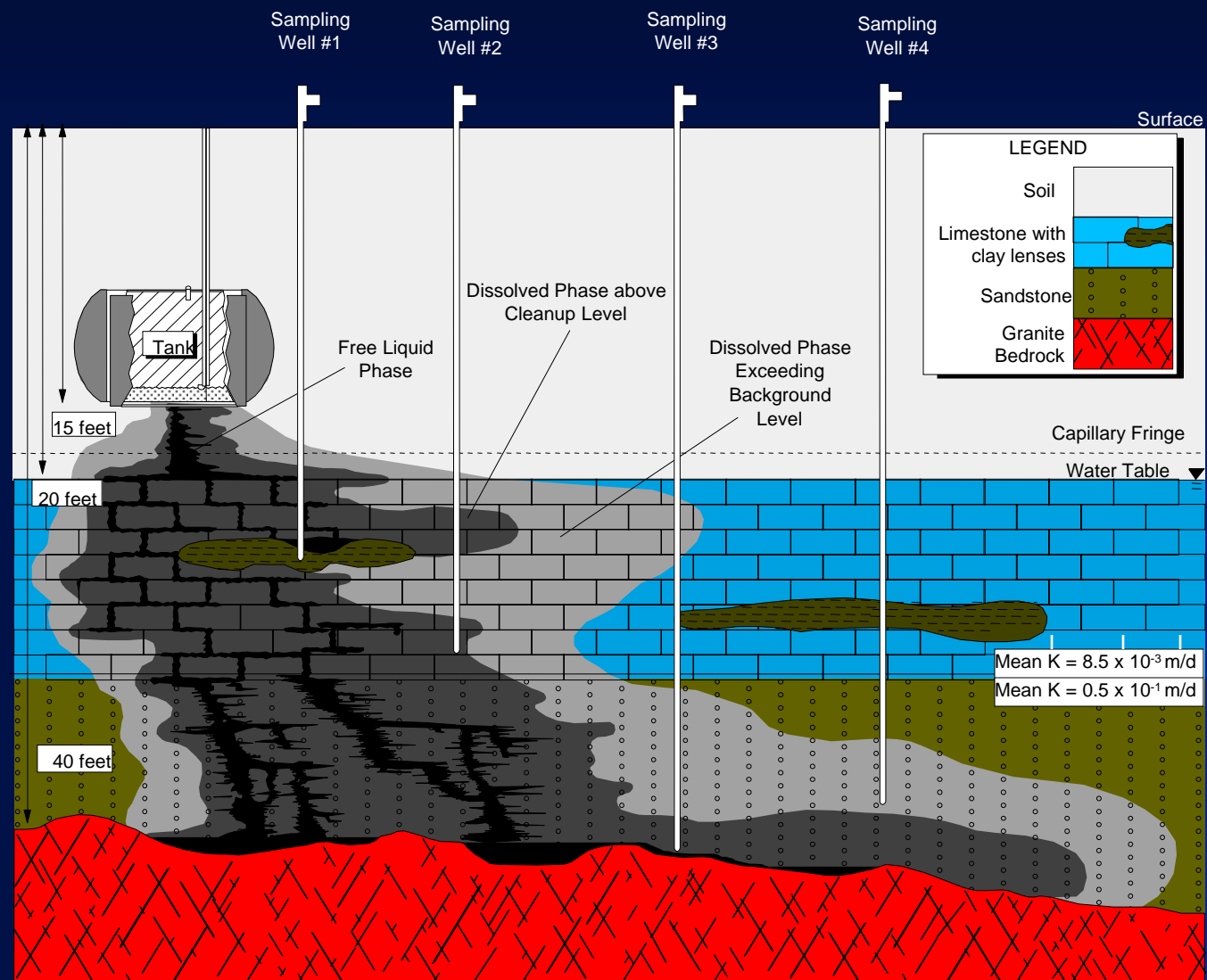


# Categorizing impacts of uncertainties

- **Example Decision Rule: If the underground tank is continuing to release TCE and Tc-99 to the Environment, as indicated by liquid in the tank, remove tank**

Probable Condition	Reasonable Deviation	Probability of Occurrence	Time to Respond	Potential Impact	Monitoring/ Investigation	Contingency Plan
Saturated soil conductivity expected to be 10E (-4) cm/s	Conductivity likely to range from 10E(-2) to 10E(-7) cm/s	High. (based on existing hydrogeologic data)	Long.	Low. May impact the drainage of rainwater if < 10E (-4) cm/s	N/A	Insignificant. No impact on likely response action.
Soil is expected to be stable (i.e., greater than Class C)	Soil may be unstable (i.e., slump slope < 50% or soil is less stable than Class C)	Low. (based on results of previous slump tests)	Short. (excavation face may sluff or cave in)	High. -Threat to worker safety - Could increase cost or delay schedule	Conduct visual inspection and additional slump tests	Significant -Shore walls - Lay back excavation
Tank and its contents are expected to be low-level waste	Subtitle C debris management rule may be applicable (i.e., tank/contents could be hazardous or mixed waste)	Medium. (based on process knowledge)	Short. (to prevent excavation from being delayed)	High. - May delay excavation - May increase disposal costs and change handling requirements	Sample and analyze tank contents; compare results to regulatory criteria	Significant. Develop contingency plans for excavation, storage, and disposal of hazardous wastes; analyze cost impacts to ensure available funding.





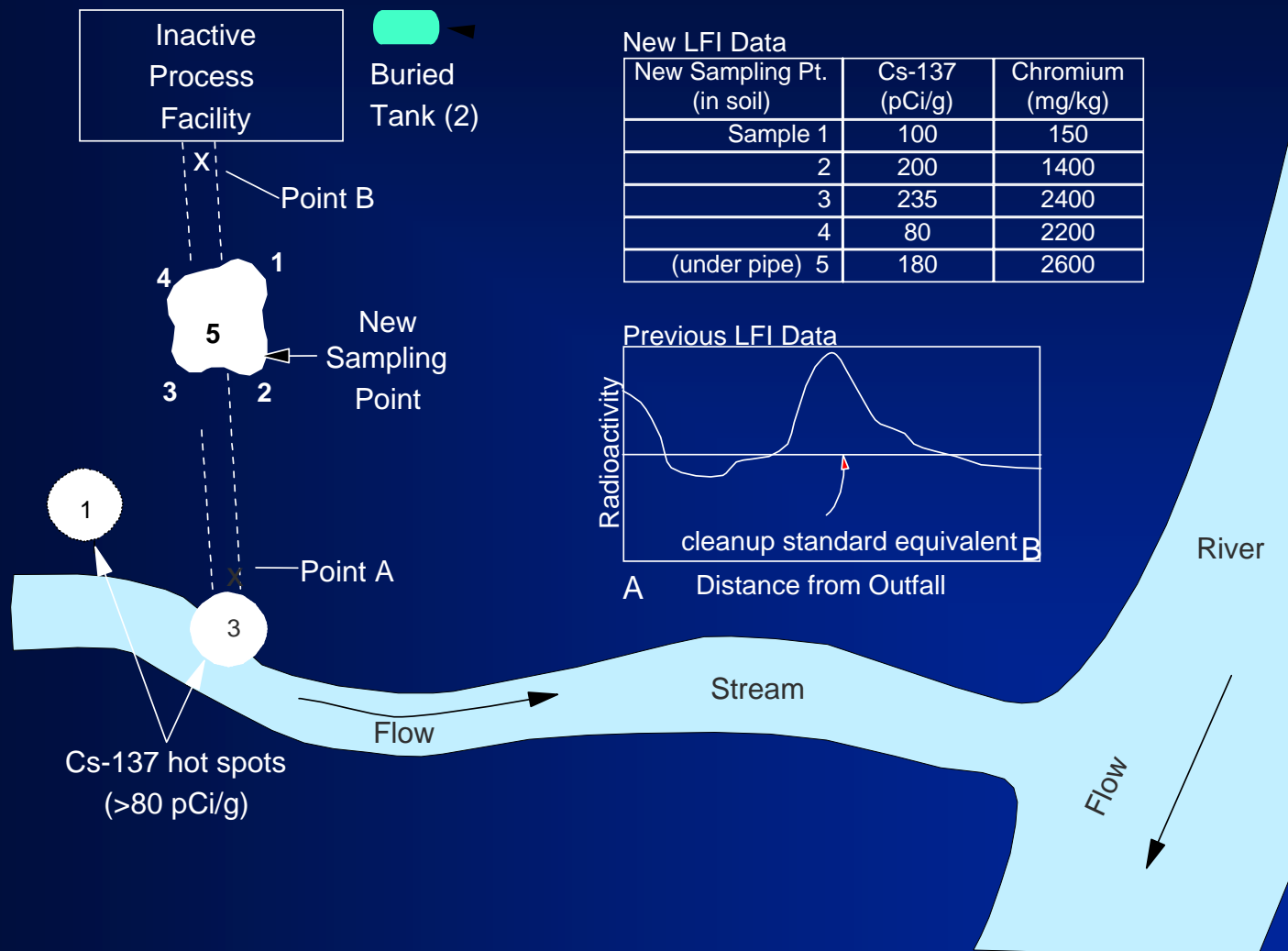
### **Documenting uncertainty using decision rules**

**□ Uncertainty: Is the tank a mixed low-level waste?**

**If the tank is excavated and cannot be managed under RCRA debris regulations, then manage as a mixed waste; otherwise, manage as a low-level waste**

# Site Characterization and Treatability Studies

## Pipe-in-trench problems



# Uncertainty matrix for pipe-in-trench example

Probable Condition	Reasonable Deviation	Probability of Occurrence	Time to Respond	Potential Impact	Monitoring/ Investigation	Contingency Plan

### **Support Activities**

- ❑ **Obtaining access to investigation areas**
- ❑ **Procuring contractors, equipment, supplies**
- ❑ **Selecting and coordinating with an analytical laboratory**
- ❑ **Procuring on-site facilities for RI activities**
- ❑ **Providing storage/disposal for RI-derived waste**

### Field Investigation

- ❑ Define, as appropriate to problem being addressed:
  - Site physical characteristics
  - Sources of contamination
  - Nature/extent of contamination
  - Contaminant fate and transport
- ❑ Sampling methods for obtaining site data are techniques outlined in the Superfund Compendium of Field Operations Methods (EPA/540/P-87/001). Table 3-1 of RI/FS Guidance identifies relevant chapters from Methods

## Nature and Extent of Contamination

*Would like to emphasize:*

- ❑ Due to inherent uncertainties, it is impossible to characterize definitively the nature and extent of contamination
- ❑ Characterize to the extent necessary to make or support a decision
  - Keep objectives of RI/FS in mind when performing field program
  - Can perform as part of early action which reduces uncertainty

### **Nature and Extent of Contamination (cont'd)**

- ❑ **Site characterization is adequate when:**
  - **DQOs are met**
  - **Risks posed by the site are adequately defined**
  - **Need for remedial action (or lack thereof) is demonstrated**
  - **Rationale for selecting a remedial action alternative is supported**



## **Contaminant Fate and Transport**

- ❑ **Models may be used and based on:**
  - **Observed extent of contamination**
  - **Site physical and source characteristics**
  
- ❑ **Sophisticated modeling techniques may not be necessary if:**
  - **Site conditions are well understood**
  - **Potential effectiveness of different remedial actions can be easily evaluated**

# Communication During Site Characterization

- ❑ DOE provides the following to EPA and state:
  - Any revisions to work plan for review and comment
  - Information on the contaminant types and affected media for ARAR identification
- ❑ DOE should keep community apprised of site activities as outlined in the community relations plan
- ❑ DOE provides ATSDR with RI report

## **Site Characterization Deliverables**

- ❑ Preliminary site characterization summary (PSC)
- ❑ Draft RI report
- ❑ Final RI report
- ❑ Maybe a risk assessment report

# Treatability Studies

- ❑ Treatability studies conducted during RI/FS are generally used to:
  - Determine whether a technology can achieve the remedial action goals that will be specified in the Record of Decision (ROD)
  - Provide information to support detailed analysis and remedy selection
- ❑ Treatability studies conducted during Remedial Design/Remedial Action (RD/RA) are generally used to:
  - Verify that the technology can achieve ROD goals
  - Optimize design and operating conditions
  - Improve cost estimates

### **RI/FS Treatability Investigations**

- ❑ In addition to the interest in streamlining, the RI/FS has an increased need to perform treatability investigations as a result of SARA's emphasis on treatment to the maximum extent practicable (MEP)
- ❑ Objective is to reduce performance and cost uncertainties
- ❑ Need for treatability studies should be identified as early as possible to avoid delays in the RI/FS schedule
- ❑ Include treatability study as part of the statement of work, when possible

## **Testing Program Design/Implementation**

- ❑ Conduct literature survey**
- ❑ Prepare work plan, sampling and analysis plan, health and safety plan**
- ❑ Perform field sampling, if required**
- ❑ Implement testing program**
- ❑ Evaluate and interpret test results and document in report**

# Scale of Treatability Studies

### Bench Testing

Laboratory test to determine if the chemical parameters of the process work

Used to determine broad operating conditions necessary

Cost usually low

Small volumes of waste

Performed quickly

Performance levels will be difficult to assess

Difficult to scale up

### Pilot Testing

Simulate physical and chemical of full-scale process

Bridge between bench and full-scale; conditions pre-lab tests may be

Costs are high

Larger volumes of waste

Requires significant amount of time

Allows closer approximation of levels

### **Bench Versus Pilot Testing**

- ❑ Bench vs. Pilot testing is a function of:
  - Level of development of technology
  - Composition of the waste
  - Nature and representativeness of desired data
- ❑ Bench studies may be sufficient for a technology that is well developed



## **Bench Versus Pilot Testing (cont'd)**

- ❑ **Pilot tests may be necessary if:**
  - **Information needed to operate the technology at full-scale is limited**
  - **There is a need to investigate secondary effects of the process**
  - **The waste being tested is complex and/or unique**

## **Pilot-Scale Testing Considerations**

- ❑ **Obtaining representative samples so that results are representative of full-scale operation**
- ❑ **Shipment of hazardous materials**
- ❑ **Disposal of test residuals**
- ❑ **Risks to workers and community during tests**

## **Treatability Study Considerations**

### ***RCRA Sample Exclusion Rule:***

- ❑ Exempts samples containing RCRA hazardous waste used in off-site treatability studies from permit requirements under Subtitle C of RCRA
- ❑ Quantity of excluded of contaminated media from Subtitle C regulation recently has been increased
- ❑ Treatment exclusion is effective immediately upon publication only in the non-authorized states
- ❑ If RCRA-authorized states choose to adopt this rulemaking, they must do so independently
- ❑ Does not apply to non-RCRA (i.e., non-hazardous) wastes

## Potential EPA Sources of Treatability Information

- ❑ Superfund Innovative Technology Evaluation (SITE) Program
- ❑ ORD/RREL Technology Support Branch Ben Blaney (513-569-7406) START program
- ❑ Guide for Conducting Treatability Studies Under CERCLA, Interim Final, EPA/540/2-89/058, December 1989. ([www.epa.gov/oswer](http://www.epa.gov/oswer))
- ❑ Technology Screening Guide for Treatment of Contaminated Soils and Sludges, EPA/540/2-88/004, September 1989
- ❑ Treatability Study Clearinghouse Abstracts, EPA/540/2-89/001, August 1989

## Potential EPA Sources of Treatability Information (cont'd)

- ❑ Summary of Treatment Technology Effectiveness for Contaminated Soil, EPA/540/2-89/053, December 1989
- ❑ Treatment Technologies for Hazardous Wastes at Superfund Sites - A Guide, EPA/54-2-89/052, February 1989
- ❑ "Treatability Studies Under CERCLA: An Overview," OSWER Directive 9380.3-02FS, December 1989
- ❑ Alternative Treatment Technology Center (ATTIC), 1-800-424-9386

### **Module 5 Summary**

- ❑ **The purpose of site characterization is to define and describe areas that pose a threat to human health and the environment**
- ❑ **During site characterization, it is important to define, as appropriate to the site:**
  - **site physical characterization**
  - **source of contamination**
  - **nature/extent of contamination**
  - **contaminant fate and transport**

### Module 5 Summary (con't)

- ❑ **Site characterization is adequate when:**
  - DQO's are met
  - Risk posed by the site are adequately defined
  - Need for remedial action (or lack thereof) is demonstrated
  - Rationale for selecting a remedial action objective is supported
- ❑ **Treatability studies are used to determine whether a technology will be successful in meeting remedial action goals. Information collected during treatability study will be used to select the remedial action.**

## **Exercise 4: Case Study on Scoping and Site Characterization**

### **□ Exercise Objectives:**

- Provides practice carrying out a site characterization**
- Reinforce the main objectives of the site characterization module**